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SPSPro - FBComp

OPERATION MANUAL

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Support for licensed users on any topics covered in this manual and for the use of the software described herein may be obtained from:

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1 OVERVIEW

FBComp is a Microsoft Windows software program for the computation of OBC survey receiver group coordinates using any combination of acoustic ranges, bearings, USBL X and Y, constrained receiver positions (e.g. from GPS) and first breaks.

This program cannot be licensed as a standalone product, but may be used as an optional module as part of the SPSPro program.

The computation of receiver group coordinates requires three initial sets of data:

- Shotpoint or pinger locations in SPS or UKOOA P1/90 format
- Initial receiver group locations (preplots or as-laid locations) in SPS format
- Acoustic and/or first break data in a user defined format

To start the FBComp module, from the SPSPro main toolbar click the *FB Comp* button.

1.1 First Break Computational Model

For first break pick times the position of each receiver is computed independently by the following steps:

1. The algorithm computes the coefficients of the best fit polynomial of user specified order which relates the data – typically, but not necessarily, pick time – to the source to receiver distances derived from the coordinates.
2. An equivalent range for each pick time is computed by applying the polynomial derived in step 1.
3. The receiver coordinates are adjusted by method of least squares using the ranges computed in step 2, as well as any acoustic data if available, optionally rejecting statistically bad data.
4. The sequence of operations is reiterated from step 1 until convergence is achieved, i.e. the maximum adjustment in step 3 does not exceed the user specified convergence criterion.

1.2 Accuracy Considerations

The accuracy of the result depends mostly upon:

- Data quality. This in turn depends on factors such as the consistency of the picking algorithm; and the state of the signal propagation media.
- Suitability of the order of polynomial chosen. This should typically be one more than the number of velocity layers present.
- Geometry of distribution of data. It is essential that the distribution of data in any two opposite directions is close to equality. Ideally, data should be as evenly distributed as possible in all directions i.e. they should have a circular, or doughnut shaped, distribution.
- Homogeneity of the near surface geology. A high horizontal velocity gradient will tend to invalidate the polynomial model for a significant number of picks, resulting in a horizontal bias.
- The accuracy of the source coordinates.

2 PROJECT

A project must be created before first time use. To create a new project, from the main menu, select *File* | *New Project*, and enter a project name.

To save all the parameters and options as described in the following sections select from the menu *File* | *Save Project* or *File* | *Save Project As*.

To load a previously saved project select from the menu *File* | *Open Project*, or *File* | *Recent Projects.*

The current project name appears in the status bar below the main FBComp window.

3 FILE SETUP

3.1 SPS Format

The software will attempt to automatically detect which SPS format revision (1.0 or 2.1) in which input files are recorded. If it is unable to so (e.g. there is no file header) then the user will be prompted to enter the format revision.

Important: processing will be impossible without the correct format revision specified.

3.2 Source Files

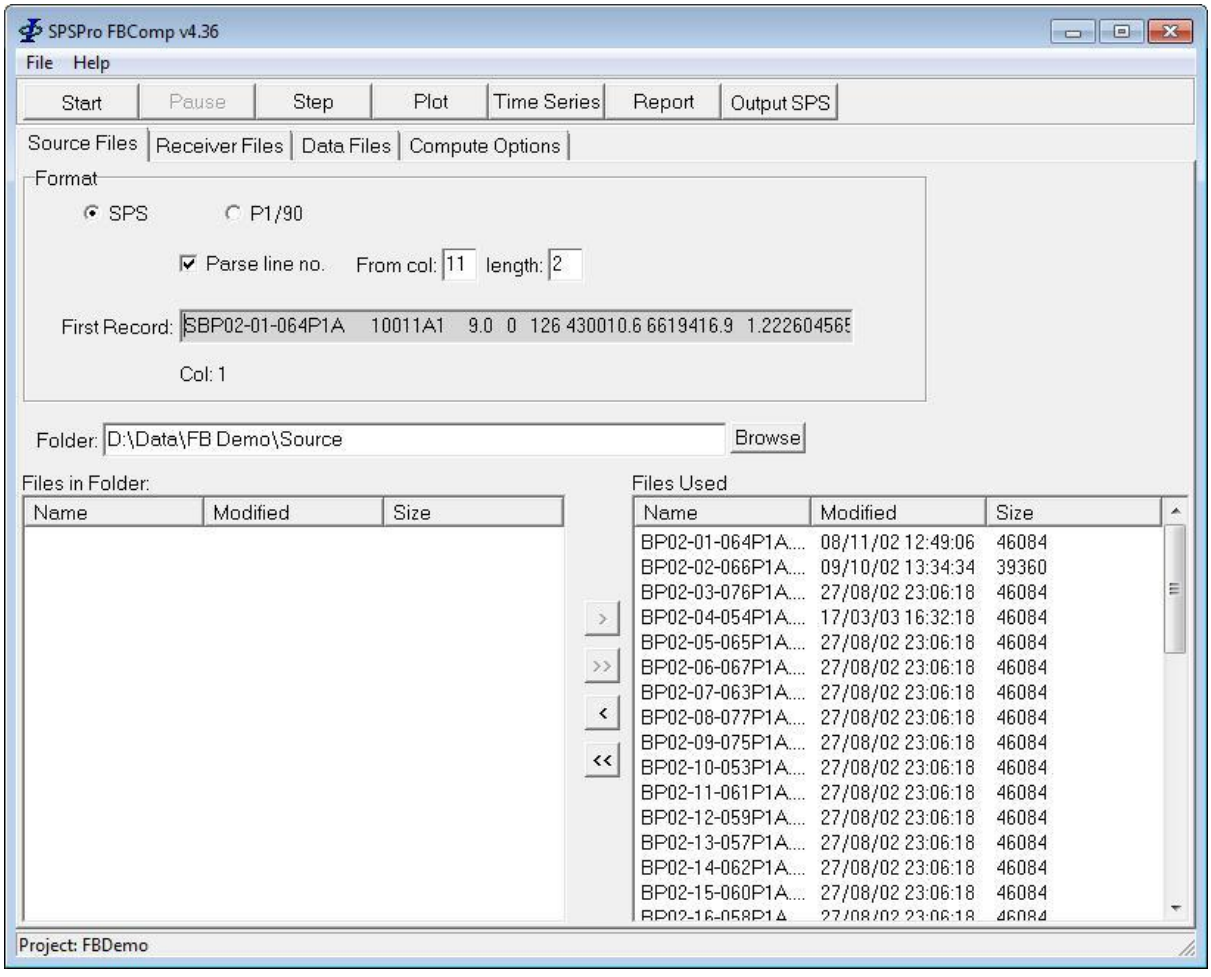


Figure 3-1

The source files contain the source locations corresponding to the first breaks or acoustic pings. To select which source files to use set the folder name and use the arrow buttons to

select the files.

SPS and UKOOA P1/90 formats are supported, but cannot be mixed i.e. all files must be of the same format.

3.2.1 SPS Format

When specifying source files recorded in the SPS Revision 1 format, the format parameters are used to specify which columns in the SPS records are used to identify the source line number. These are specified by entering the *from col* and *length*. This number corresponds to the source line number specified in the first break data files. The example in Figure 3-1 shows a source line number of 64.

When specifying source files recorded in the SPS Revision 2.1 format, no parsing of the line name field is normally necessary, but may be if the data files do not contain the full source line number..

For both formats the *Parse line no.* checkbox must be checked to enable parsing.

3.2.2 UKOOA P1/90 Format

When selecting UKOOA P1/90 format the format panel changes to allow the user to specify which record types should be imported. The options are:

Record ID: Column 1 of the P1/90
Vessel ID: Column 17
Source ID: Column 18
Other ID: Column 19

If any of these fields are non-blank then only records containing specified character in the respective column will be imported, subject to the settings in the remaining columns.

3.3 Receiver Files

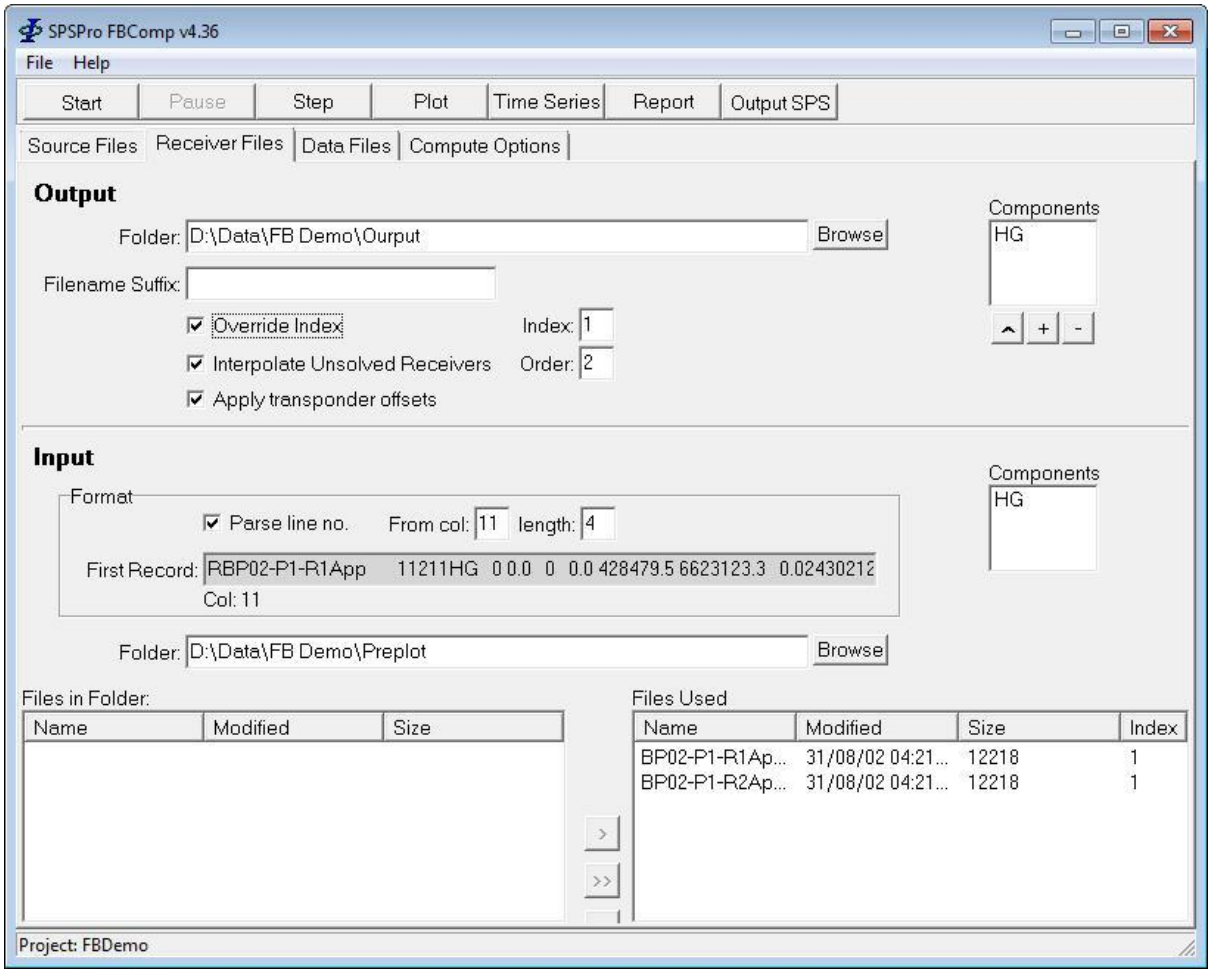


Figure 3-2

The receiver files contain the initial coordinates of the receivers whose positions are to be solved. These would typically be pre-plot or initial drop locations. The receiver files must be in SPS format. To select which receiver files to use set the folder name and use the arrow buttons to select the files.

3.3.1 Format

When specifying source files recorded in the SPS Revision 1 format, the format parameters are used to specify which columns in the SPS records are used to identify the receiver line number. These are specified by entering the *from col* and *length*. This number corresponds to the receiver line number specified in the first break data files. The example in Figure 3-2 shows a receiver line number of 1.

When specifying receiver files recorded in the SPS Revision 2.1 format, no parsing of the line name field is normally necessary.

For both formats the *Parse line no.* checkbox must be checked to enable parsing.

3.3.2 Output

For each input SPS receiver file a corresponding output file is in the SPS format and will be written. This file will be identical to the input file except for the computed values – Easting, Northing and optionally depth

Specify the output folder where the output file are to be written. Optionally also specify a filename modifier which will appear in the filename immediately before the filename extension.

3.3.3 Components

When the input file is read the input component list is populated with the instrument codes found in the input file. Before exporting the computed SPS file the output component list must be populated using the following buttons:

 Add the selected items in the input component list to the output component list.

 Define and add a new instrument code, maximum 2 characters.

 Remove the selected instrument codes.

3.3.4 Index

The index refers to the point index recorded in the R records.

If the input file contains a value for point index in the first record then this will appear in the *Files Used* list. If no index is found then an index value of 1 is used. The values for selected files may be changed by selecting the files, right clicking, and selecting *Set Receiver Index* from the popup menu.

The specified index for each file is written to the R records when outputting the computed receivers.

To override the index in all files check the *Override Index* checkbox, and enter the value to output.

3.4 Data Files

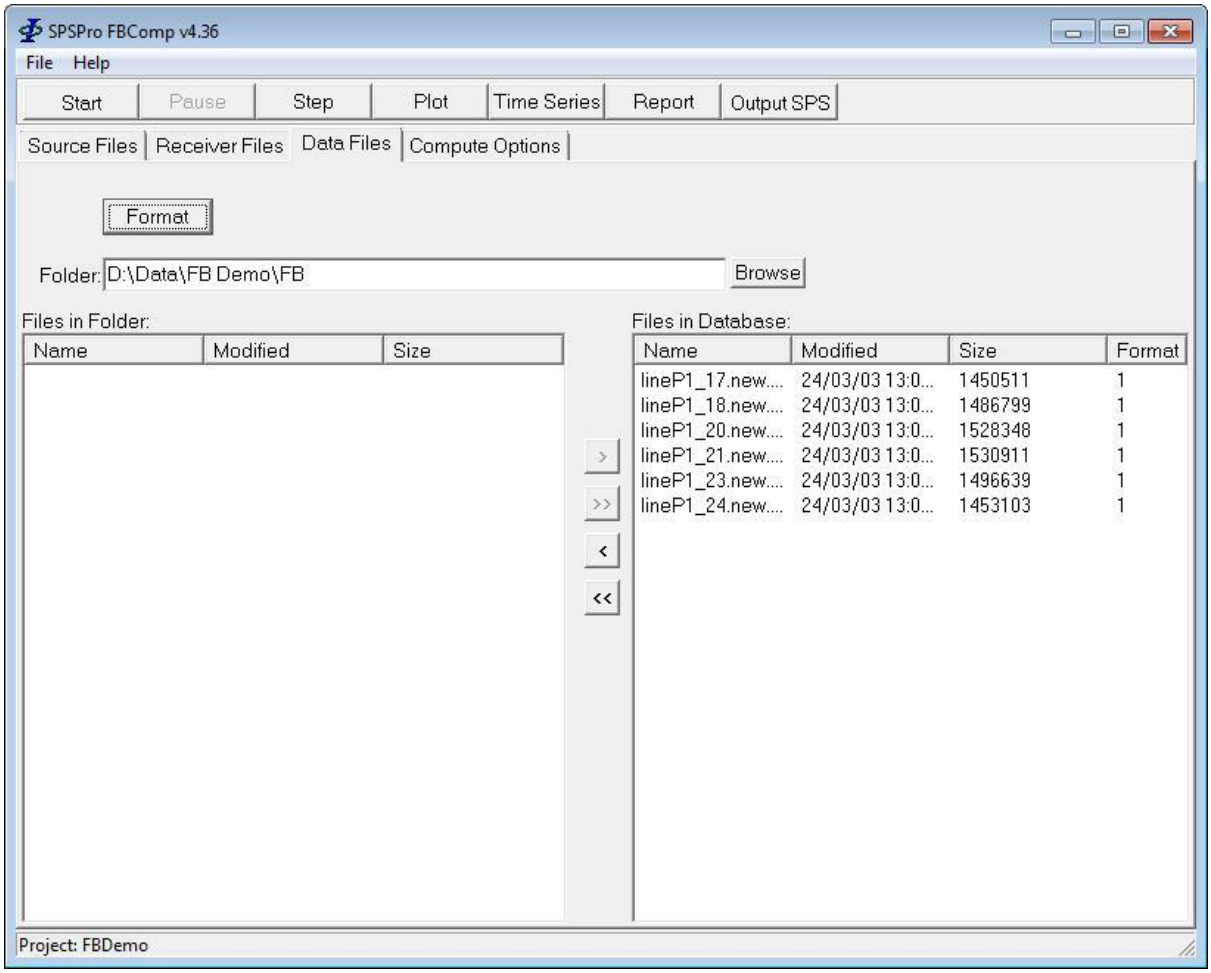


Figure 3-3

The data files contain the actual first break pick times (or acoustic travel times or ranges). To select which data files to use set the folder name and use the arrow buttons to select the files.

The following data types are supported:

- First break pick time
- Acoustic 1-way or 2-way travel time, not including turnaround time
- Acoustic 1-way range
- USBL X
- USBL Y
- USBL Z

- Bearing
- Heading (gyro) for use with USBL data

3.4.1 Format

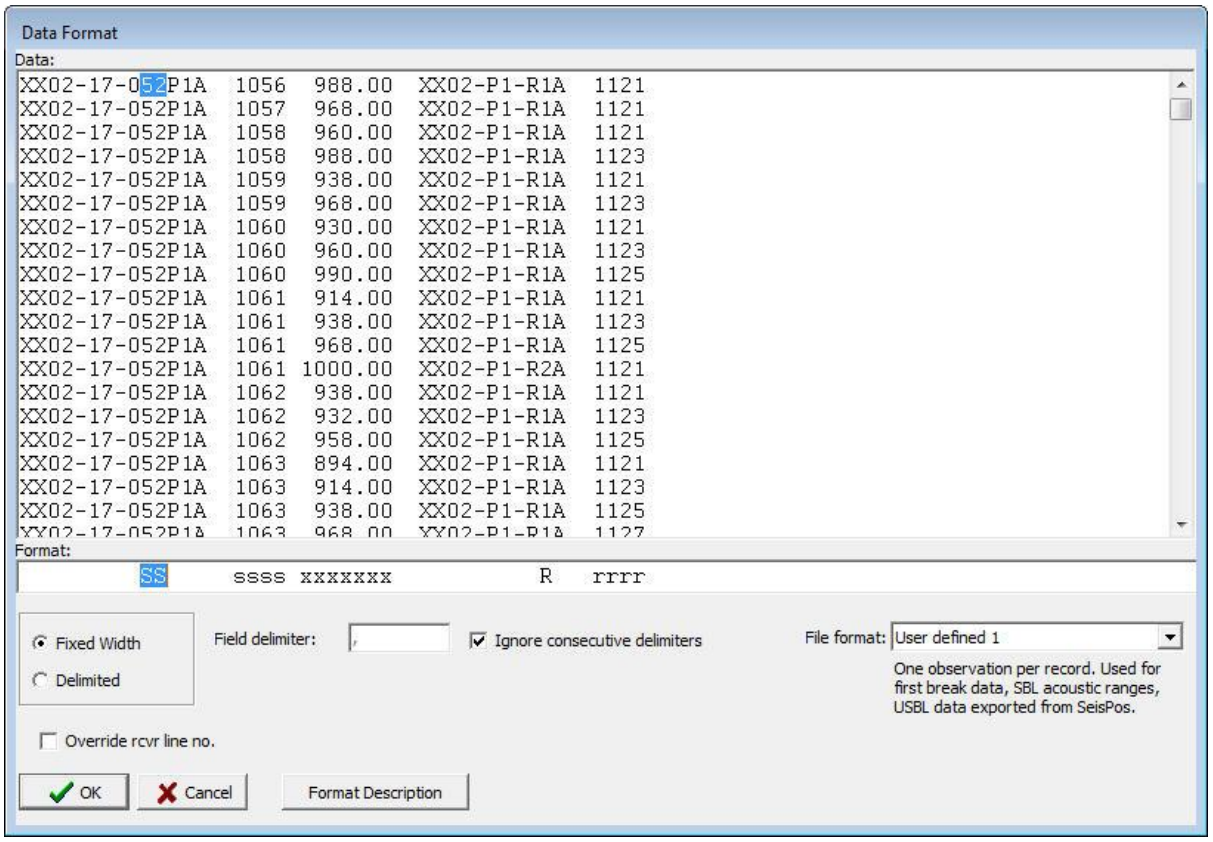


Figure 3-4

The format for a each file must be specified to tell the program how to read the data in the file. Combinations of different types of files are supported, allowing a hybrid solution for example using first break picks and acoustics, in a single integrated solution for each receiver.

Important: Each file must contain a homogenous set of records.

To set the format first select the files in the *Files in Database* list to which the format is to apply, then click the *Format* button. The format dialog appears and the first selected file will be displayed for reference, as shown in the example in Figure 3-4.

Two basic formats are supported:

User defined 1 Each record contains a single data value, e.g. first break pick time.

User defined 2: Each record contains multiple data values, e.g. USBL range and bearing.

Each record must also contain sufficient information to correlate the data to the source or pinger and receiver.

The record format is described by a format string entered by the user which consists of a series of format specifiers which are characters that describe the various fields.

Note: the format specifiers are case sensitive.

File records must be terminated with a carriage return/line feed or a line feed only (Unix).

3.4.1.1 User Defined 1 Format

Format Specifier	**Field in File Record**	**Description**
D	Day of year (Julian day)	Optional. Corresponds to the day in the source file. This should be omitted if the source file does not contain the day.
h	time	Optional. This must be in the format hh:mm:ss, and corresponds with the time in the source file. This should be omitted if the source file does not contain the time.
S	source line number	The number corresponding to the line number specified in the source file, described in section 3.2.1 above. If only one line is present then this may be omitted. If omitted then the line number column as shown in Figure 3-1 must be set to a blank column.
s	shotpoint number	Optional. The shotpoint number or pinger fix number corresponding to the number in the source file. This field is only used if time is not specified.
R	Receiver line number	The number corresponding to the line number specified in the receiver SPS files, described in section 3.3.1 above. If only one line is present then this may be omitted. If omitted then the line number column as shown in Figure 3-2 must be set to a blank column.
r	Station number	The receiver number corresponding to the number in the SPS receiver file.
n	Receiver index number	Optional. The index number corresponding to the index in the SPS receiver file.
x	Data value	One of:

Format Specifier	Field in File Record	Description
		first break pick time acoustic travel time horizontal range slope range bearing USBL X USBL Y
T	Data type – this describes the type of data present in the data value field.	not specified or T= FB pick time X = USBL X Y = USBL Y H = horizontal range L = slope range or acoustic travel time B = bearing
g	Vessel heading	If using USBL X or Y based on a local coordinate system such as the vessel coordinate frame then this must appear in the same record.
Z	Source/pinger to receiver depth	If specified with slope ranges then slope ranges will be converted to horizontal ranges using the depth value.
D	Transponder delay	Acoustic transponder delay, or turnaround time, in the same units as the data. This value is subtracted from the data value before scale is applied. Optional.

3.4.1.2 User Defined 2 Format

Format Specifier	Field in File Record	Description
h	time	This must be in the format hh:mm:ss, and corresponds with the time in the source file. **Note:** the total time in any one complete dataset must not exceed a period of 24 hours.
S	source line number	The number corresponding to the line number specified in the source file, described in section 3.2.1 above. If only one line is present then this may be omitted. If omitted then the line number column as shown in Figure 3-1 must be set to a blank column.
s	shotpoint number	The shotpoint number or pinger fix number corresponding to the number in the source file.

Format Specifier	Field in File Record	Description
R	Receiver line number	The number corresponding to the line number specified in the receiver SPS files, described in section 3.3.1 above. If only one line is present then this may be omitted. If omitted then the line number column as shown in Figure 3-2 must be set to a blank column.
r	Station number	The receiver number corresponding to the number in the SPS receiver file.
H	Horizontal range	
L	Slope range or acoustic travel time	
B	Bearing	
X	USBL X	X coordinate in the coordinate frame whose y-axis orientation is defined by the value in the heading field.
Y	USBL Y	Y coordinate in the coordinate frame whose y-axis orientation is defined by the value in the heading field.
Z	USBL depth	Positive down.
g	Vessel heading	If using USBL X or Y based on a local coordinate system such as the vessel coordinate frame then this must appear in the same record.
D	Transponder delay	Acoustic transponder delay, or turnaround time, in the same units as the data. This value is subtracted from the data value before scale is applied. Optional.

3.4.1.3 Predefined Formats

The following predefined formats are supported:

Trackpoint Range: Selecting this format automatically sets the format string to read range data recorded in the Trackpoint II format.

Trackpoint R.B: Selecting this format automatically sets the format string to read range and bearing data recorded in the Trackpoint II format.

Trackpoint X/Y: Selecting this format automatically sets the format string to read USBL X and Y data recorded in the Trackpoint II format.

SeisPos SPSv2.1: Selecting this format automatically sets the format string to read acoustic slope range (m) recorded in the SeisPos format.

After selecting any of the above formats it is still possible to further modify the format string.

Examples are:

- to include USBL Z in order to compute depths when selecting the Trackpoint X/Y format.

3.4.1.4 Fixed Width Fields

The format specifiers must match exact file positions

e.g:

```
data:   ABC1001P001 1001 S01L1234 0101 768.5
format:    SSSS     ssss     RRRR rrrr ttttt
```

3.4.1.5 Delimited Fields

Only one format specifier is used to represent a field. Any character other than those specified in sections 3.4.1.1 and 3.4.1.2 will cause that field to be skipped.

The field delimiter character(s) must bespecified. A tab character is represented by ^*t*.

e.g:

```
data:   1001,1001,skip,1234,0101,768.5,2
format: Ss#Rrtn
field delimiter: ,
```

3.4.1.6 Receiver Line Number

There are occasions when the receiver line number as recorded in the input file, usually the preplot, is incorrect or incomplete and therefore does not match the line number that appears in the data records, If this situation arises then the line number may be overridden by checking the *Override rcvr line no.* checkbox and entering the correct line number.

4 COMPUTE OPTIONS

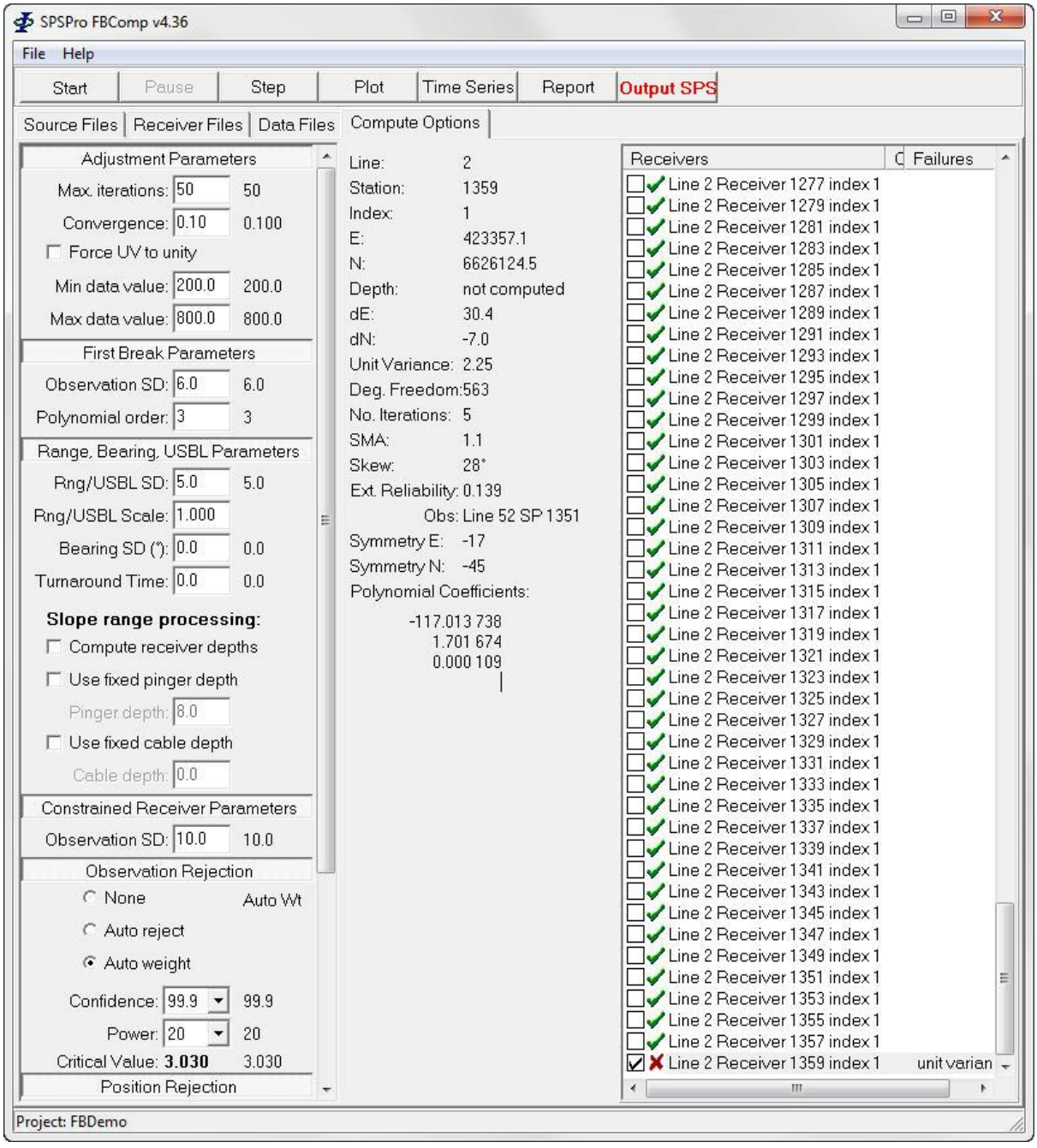


Figure 4-1

The various parameters, displayed in the left of the Compute Options page, are divided into

7 groups. Click the group button to display or hide the group parameters.

4.1.1 Adjustment Parameters

Max iterations: The maximum number of iterations allowed to achieve convergence. The default value of 10 is most appropriate

Convergence: The correction to coordinate easting or northing, between iterations, below which the solution is considered to have converged.

Force UV to unity: When checked the observation a priori SDs are varied to force the unit variance to be close to 1.

Min data value: The minimum data value to be used. Also applies to acoustic range data (see below).

Max data value: The maximum data value to be used. Also applies to acoustic range data.

The minimum and maximum pick times can be specified to improve the pick geometry by forcing a more even distribution.

4.1.2 First Break Parameters

Observation SD: The a priori standard deviation to be used for all *ranges* i.e. the output of the polynomial function. A value resulting in a mean unit variance of unity should be used.

Polynomial order: Order of the polynomial function relating data values to source-receiver distances. As a general guide this should be one more than the number of velocity layers present. For acoustic ranging (1 velocity layer) a value of 2 should be sufficient.

4.1.3 Range, Bearing, USBL Parameters

Range/USBL SD: The a priori standard deviation to be used for all range and USBL observations. A value resulting in a mean unit variance of unity should be used.

Range/USBL scale: The scale to be applied to all range and USBL observations. This value should be 1.0 unless a correction for propagation speed is required e.g. enter a value of 1.5 to correct from acoustic travel time in ms to distance in m for a propagation speed of 1500m/s. The scale may also be used to correct for calibrated speed of sound e.g. if acoustic times have been converted to slope ranges using 1500m/s but the observed speed of sound was 1540m/s then set the scale to 1540/1500 = 1.0267.

Bearing SD: The a priori standard deviation to be used for all bearing observations. A value resulting in a mean unit variance of unity should be used.

Turnaround Time: The amount, in the same units as the data (usually ms) of the

acoustic transponder delay. This value is subtracted from the data value before scale is applied.

Compute Rcvr depths: Check to compute receiver depths. Depths for a receiver will only be computed if there are slope range or USBL Z observations present for that receiver. In very shallow depths the ping geometry may not be sufficient to successfully compute depths in which case this option should not be used.

Use fixed pinger depth: Check this checkbox and enter the pinger depth. This value will be added to receiver depths computed from slope ranges. This should be a positive value.

Use fixed cable depth: Check this checkbox and enter the cable depth. This value will be used to correct slope ranges to horizontal ranges. If the *Use fixed pinger depth* checkbox is checked then the pinger depth value entered will also be used, otherwise the source depth in the source file will be used.

4.1.4 Constrained Receiver Parameters

Observation SD: The a priori standard deviation to be used for all constrained receiver easting and northing observations. A value resulting in a mean unit variance of unity should be used.

4.1.5 Observation Rejection Parameters

None: No statistical testing is performed.

Auto reject: If checked, auto-rejection will be implemented: the statistically bad observation will be rejected.

Auto weight: If checked, a statistically bad observation will be down-weighted.

Confidence: 100 – α where α is the percentage probability of rejecting a good observation. The default value is 99.9.

Power: The percentage probability that errors the size of the reported marginally detectable errors will be accepted. The default value is 20.

Critical value: A function of confidence, the normalised residual above which an observation will be rejected or down weighted if auto-rejection or auto-weighting is implemented.

The Delft method of data snooping is implemented for both auto-rejection and auto-weighting i.e. only the worst observation is rejected/down-weighted and the adjustment re-computed. This cycle continues until there are no more failures.

4.1.6 Position Rejection Parameters

Max delta position: A receiver whose computed position differs from its initial position by

more than the specified value will be rejected

Max SMA: A receiver whose error ellipse (95% confidence) semi-major axis exceeds the specified value will be rejected

Max extern reliability: A receiver whose computed external reliability exceeds the specified value will be rejected.

Max unit variance: A receiver for which the adjustment unit variance exceeds the specified value will be rejected.

Max symmetry: A receiver whose observation symmetry in either the E or N component exceeds the specified value will be rejected. Symmetry is a measure of the evenness of distribution of the observations. A low value indicates good symmetry, a high value indicates poor symmetry. If a receiver has a high reported symmetry then the operator should visually inspect the plot to decide whether or not the distribution of data is too lopsided to provide a reliable position. This can be done by checking and highlighting the receiver in the list and clicking the *Step* button.

4.1.7 General Parameters

Max receiver Sep: Adjacent receivers whose computed positions exceed this separation will be flagged in the report and their positions altered to meet this criterion.

Suppress error msgs: When checked execution will continue if a receiver position cannot be computed. The non-computed receiver will remain marked with a red cross.

4.2 Receivers

All receivers read from the input files appear in the receiver list when the *Plot* button or *Start* or *Step* button is pressed.

Clicking anywhere in the receiver list then pressing the <*Esc*> key will abort this operation.

For multi-component input files only one receiver for each station will appear in the list. Their status can be reset from the options in the popup menu, shown in Figure 4-2.

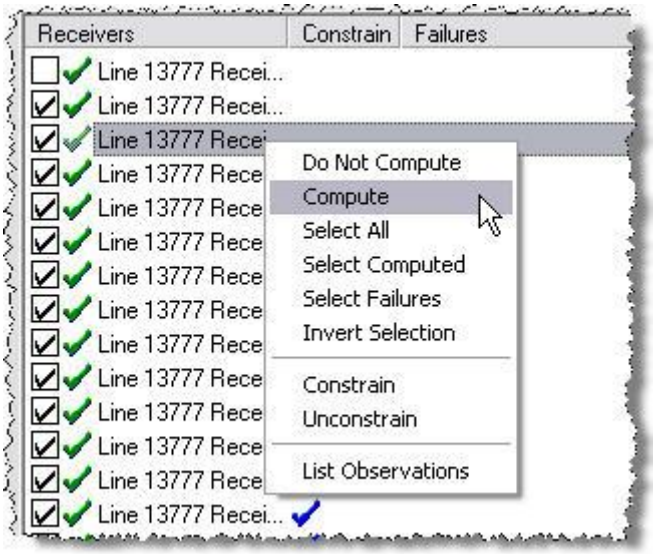


Figure 4-2

4.2.1 Constrained Receivers

A situation may arise whereby the initial receiver position is considered accurate enough to be used for the final position, e.g. drop coordinates for receivers in very shallow water with no subsequent movement. To enable this function:

1. Select the receivers which are to be constrained
2. From the receiver list popup menu, as shown in Figure 4-2, select *Constrain*.
3. Set an appropriate a priori SD under the *Constrained Receiver Parameters* group.
4. Save the project to remember these settings.

A blue tick appears in the *Constrain* column for the selected receivers.

The constrained receivers will be computed using all available observations as well as their initial easting and northing.

4.2.2 List Observations

To list all observations associated with receivers:

1. Select the receivers in the list.
2. From the receiver list popup menu, as shown in Figure 4-2, select *List Observations*.

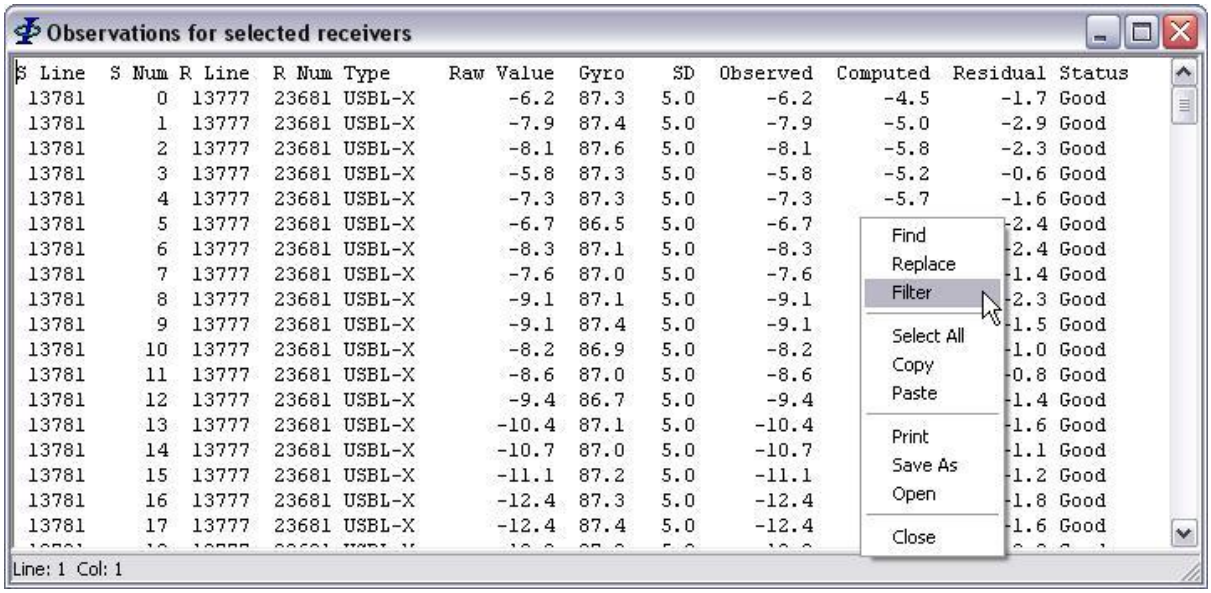


Figure 4-3

If the receiver has not yet been computed then the values for SD, Observed, Computed and Residual will be 0.

To filter the listing, for example to look at only one type of observation or one receiver or source, use the *Filter* function from the popup menu, as shown in Figure 4-3.

5 RUNNING THE ADJUSTMENT

When the *Start* button is clicked, the adjustment always starts at the first receiver in the list, and continues until the end, or until the *Pause* or *Stop* button is clicked.

When the *Step* button is clicked, the adjustment starts at the highlighted receiver and is paused after that receiver has been adjusted.

A single receiver may be adjusted by selecting it in the list, checking its checkbox and then clicking the *Step* button.

Once the solution for a receiver has converged the receiver is marked with a green tick and its checkbox is unchecked..

5.1 Receiver Attributes

During adjustment, the centre panel of the *Compute Options* page displays the following attributes for the last receiver adjusted:

- Line number
- Receiver number
- Receiver index
- Easting
- Northing
- Depth
- Delta easting (initial to final position)
- Delta northing (initial to final position)
- Unit variance
- Degrees of freedom
- Number of iterations
- Semi major axis of the 95% probability error ellipse
- The orientation of the error ellipse
- External reliability
- The observation which gives rise to the external reliability value
- Symmetry
- The polynomial coefficients

5.1.1 Time Series Plots

The following receiver attributes can be plotted during or after the computation by clicking the *Time Series* button:

- Easting

- Northing
- Depth
- Delta easting (initial to final position)
- Delta northing (initial to final position)
- Unit variance
- Degrees of freedom
- Number of observations input
- Number of observations used
- Semi major axis of the 95% probability error ellipse
- External reliability
- The polynomial coefficients

5.2 Receiver Index

If receiver index is specified in the First Break data records then the program will look for a match in the input receiver file. If Only line number and receiver number is matched, i.e. the input file contains only index 1, then a new receiver record with the new index number will be automatically created and output.

5.3 Map Plot

The network plot appears or is updated by clicking the *Plot* button or the *Start* or *Step* buttons.

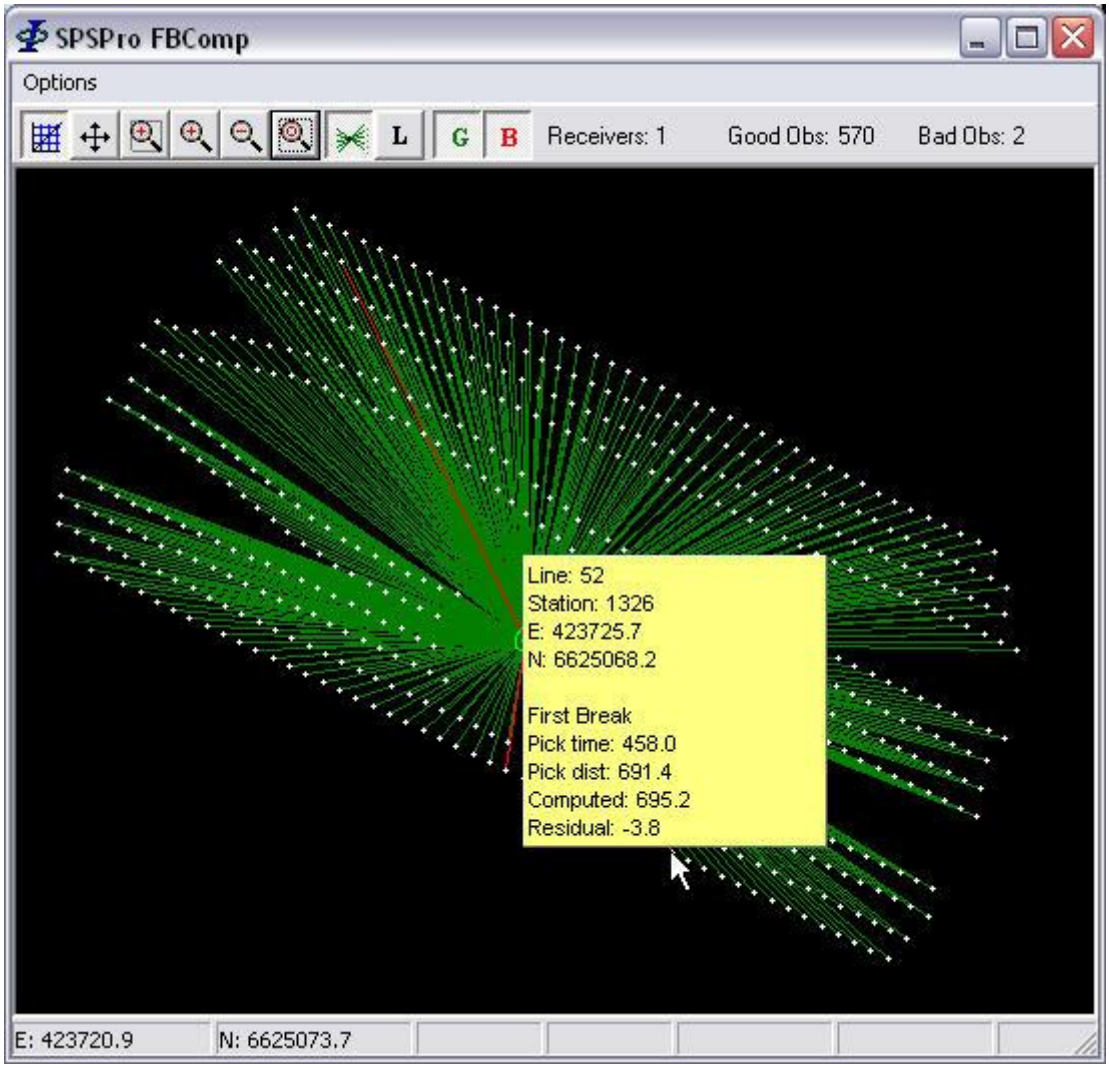


Figure 5-1

When the adjustment is started the map plot changes to display the last receiver adjusted, along with all the sources from which data is used, as shown in Figure 5-1Figure 6-1.

The following map functions are available from the toolbar:


When depressed the scale along both axes will be the same.


When depressed the image can be panned using the left mouse button.


Fixed Zoom Button, when depressed, zooming in with the left mouse button will zoom tightly around the selected points only. When out, zooming in with the left mouse button will increase the map scale and display scroll bars.


Zoom in.


Zoom out.


Zoom extents.


Toggles between single receiver display and all receiver display.


Toggles receiver and source label display.


Toggles display of un-rejected observations.


Toggles display of rejected observations.


Toggles display of error ellipses.

Data and receiver attributes are displayed by holding the left mouse button down on the source or receiver, as shown in the example in Figure 5-1.

When the mouse cursor is positioned over a station the station type symbol (S or R), line name followed by a hyphen and the station ID is displayed for each station at the cursor location e.g. *S1234-1001* corresponds to shotpoint 1001 on line 1234.

Measurements may be made by drawing a line with the right mouse button.

Click on the *Plot* button to refresh the plot, for example when the file list has changed.

5.4 Velocity Plot

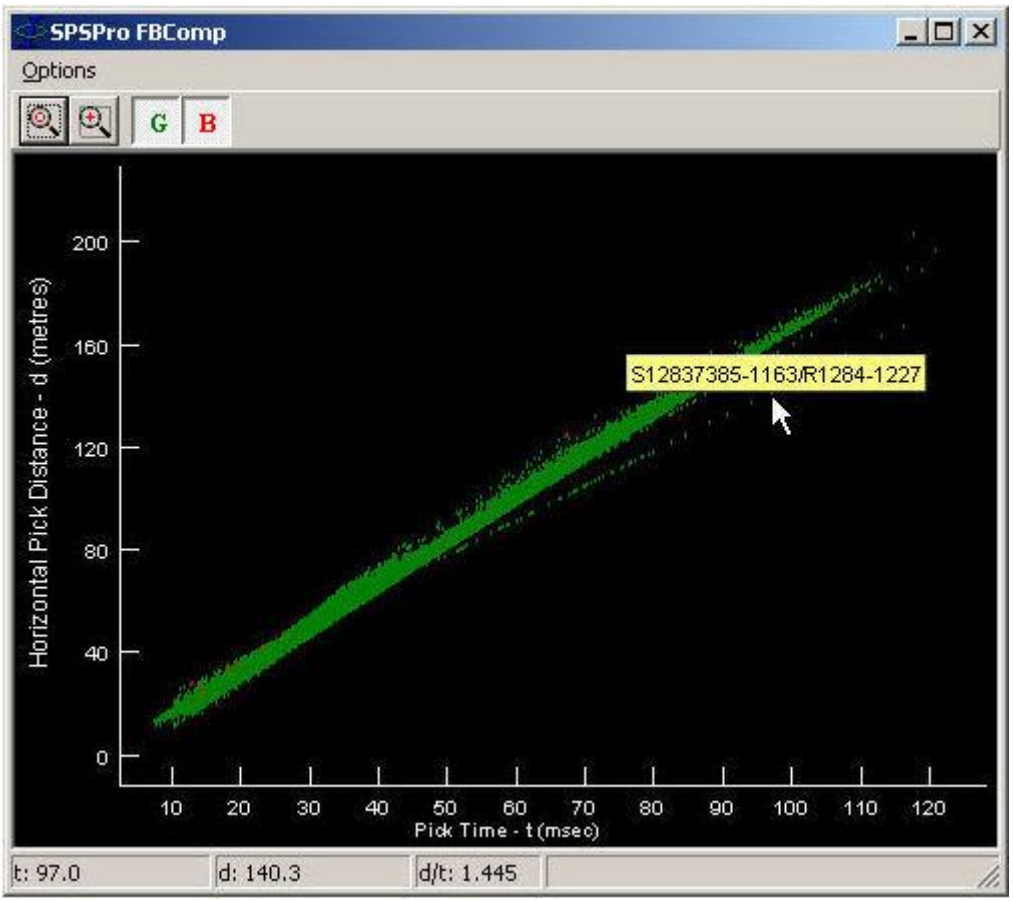


Figure 5-2

During the adjustment the pick time in milliseconds for each observation is plotted against its corresponding computed horizontal distance. Rejected observations, if auto-rejection is used, are plotted in red. Down-weighted observations, if auto-weighting is used, are plotted in yellow.

The toolbar functions are:

Zoom extents.

Fixed Zoom Button, when depressed, zooming in with the left mouse button will zoom to the rectangle only. When out, zooming in with the left mouse button will increase the map scale and display scroll bars.

Plot good picks.

Plot bad picks.

Moving the mouse over the end points of each plot displays the receiver number, as shown in the example in Figure 5-2.

The velocity at the cursor location is displayed in the status bar below the plot..

The velocity plots for all receivers in the same area should be very close. Any departures from the main trend would be indicative of either a significant sudden change in geology, or an inappropriate polynomial function i.e. incorrect order. A single receiver plot may be isolated by zooming in tightly on the plot, with the *Fixed Zoom Button* depressed.

Clicking on a pick will display the network and statistics for the associated receiver.

5.5 Depth Computation

Receiver depths will be computed if acoustic slope ranges are included amongst the observation datasets, and the *Compute Receiver Depths* checkbox is checked. Note however that good vertical geometry is essential in order to obtain a good solution for receiver depth. Ideally some data should be recorded from directly above the receivers. The quality of the depth solution will also be adversely affected if the observations are recorded over significantly different tidal heights.

Depth for the first receiver in the list is initialised to the depth recorded in the input receiver file, or a value of 10 if no depth is recorded. Depths for subsequent receivers are initialised to the last computed receiver's computed depth.

6 REPORT

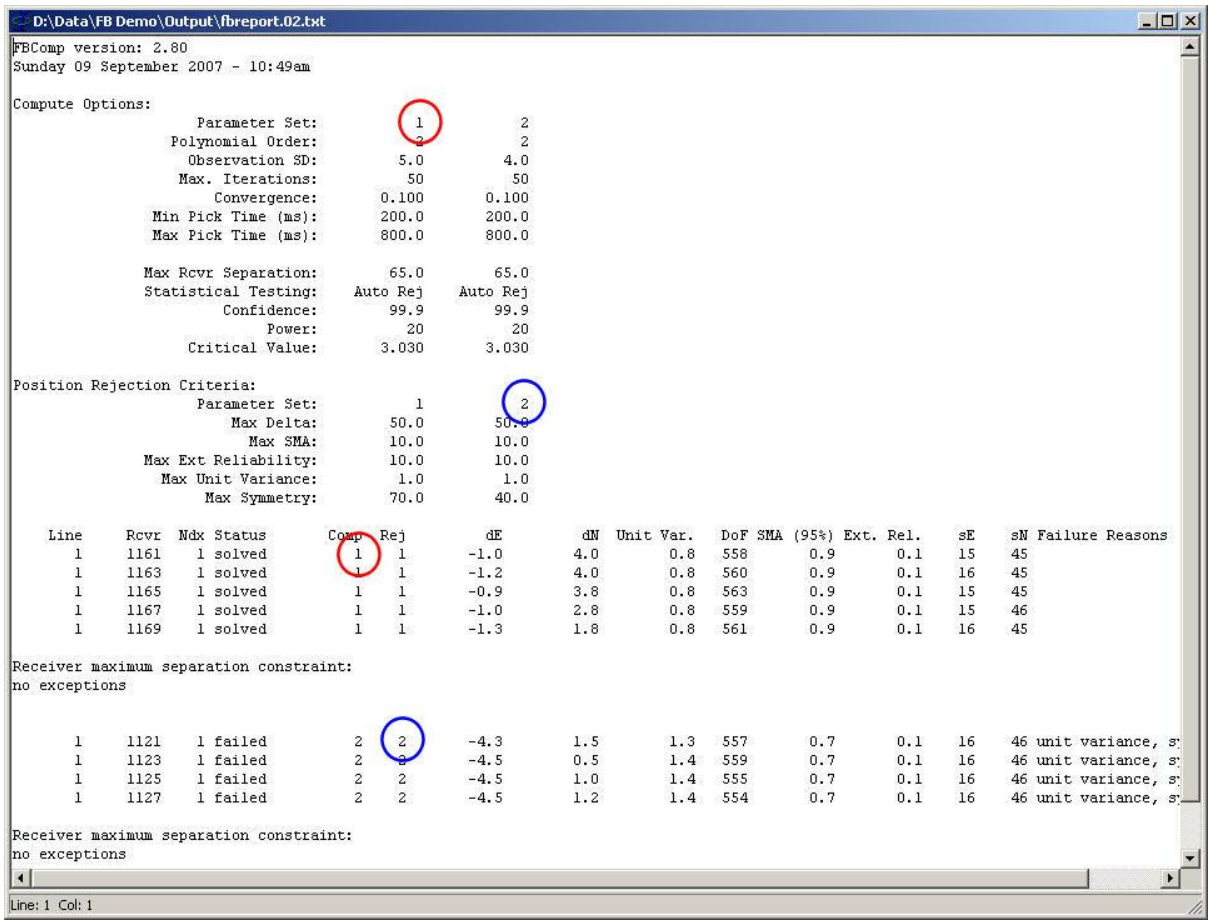
A new report is created each time a project is opened. This report contains:

- Parameter sets used
- Receiver computation statistics
- Receiver rejection reasons
- Receiver maximum separation failures

Figure 6-1 shows an example report. The red and blue circles indicate how the parameter sets are identified. For this report the parameters were changed prior to running a partial computation.

The report is automatically saved using an incremental file name with the file name and path displayed in the report title bar.

Report options are available from the from the popup menu by right clicking on the report.



D:\Data\FB Demo\Output\fbreport.02.txt

```
FBComp version: 2.80
Sunday 09 September 2007 - 10:49am

Compute Options:
                      Parameter Set:          1          2
                  Polynomial Order:          2          2
                    Observation SD:        5.0        4.0
                   Max. Iterations:         50         50
                       Convergence:      0.100      0.100
                 Min Pick Time (ms):      200.0      200.0
                 Max Pick Time (ms):      800.0      800.0

               Max Rcvr Separation:       65.0       65.0
               Statistical Testing:   Auto Rej   Auto Rej
                        Confidence:       99.9       99.9
                             Power:         20         20
                    Critical Value:      3.030      3.030

Position Rejection Criteria:
                      Parameter Set:          1          2
                          Max Delta:       50.0       50.0
                            Max SMA:       10.0       10.0
                 Max Ext Reliability:       10.0       10.0
                   Max Unit Variance:        1.0        1.0
                        Max Symmetry:       70.0       40.0

    Line     Rcvr  Ndx Status       Comp  Rej        dE        dN  Unit Var.   DoF SMA (95%) Ext. Rel.    sE    sN Failure Reasons
       1     1161    1 solved          1    1      -1.0       4.0        0.8   558       0.9       0.1    15    45
       1     1163    1 solved          1    1      -1.2       4.0        0.8   560       0.9       0.1    16    45
       1     1165    1 solved          1    1      -0.9       3.8        0.8   563       0.9       0.1    15    45
       1     1167    1 solved          1    1      -1.0       2.8        0.8   559       0.9       0.1    15    46
       1     1169    1 solved          1    1      -1.3       1.8        0.8   561       0.9       0.1    16    45

Receiver maximum separation constraint:
no exceptions


       1     1121    1 failed          2    2      -4.3       1.5        1.3   557       0.7       0.1    16    46 unit variance, s
       1     1123    1 failed          2    2      -4.5       0.5        1.4   559       0.7       0.1    16    46 unit variance, s
       1     1125    1 failed          2    2      -4.5       1.0        1.4   555       0.7       0.1    16    46 unit variance, s
       1     1127    1 failed          2    2      -4.5       1.2        1.4   554       0.7       0.1    16    46 unit variance, s

Receiver maximum separation constraint:
no exceptions
```

Line: 1 Col: 1

Figure 6-1

7 OUTPUT

To write the output SPS receiver file click the *Output SPS* button.

The output receiver files will be an exact copy of the input receiver files, including header records, with the following exceptions:

- The coordinates will be the computed coordinates.
- For each input receiver one record for each defined component will be output.
- If a receiver computation failed its instrument code will be KL regardless of the instrument codes specified.
- If more than one index is found in the first break data file but not matched in the input file then a new record will be created which is identical to the index 1 record, except that the coordinates will be for the appropriate index.

If the option to compute water depths has been used then water depths exceeding 99.9 will be written as an integer (I4) as opposed to a floating point value (F4.1).

7.1 Interpolation

It is common for acoustically positioned lines that not all receivers will be associated with an acoustic transponder. Typically every third receiver will therefore be solved.

To optionally interpolate the unsolved receivers check the *Interpolate Unsolved Receivers* checkbox. Interpolation and extrapolation is done by way of polynomial modelling using the solved receiver positions to compute the polynomial coefficients. The default order of polynomial is 3. This can be changed by entering a new value between 2 and 9 inclusive. If this order is greater than the number of solved receivers -1 then it will be automatically reduced.

7.2 Transponder Offsets

When the *Apply Transducer Offsets* checkbox is checked, transponder to receiver offsets recorded in acoustic data files produced by SeisPos will be applied. This is always checked by default. When unchecked the transponder positions will be written to the SPS output file rather than the receiver positions.